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OUT-OF-LINE SAFETY TEST OF THE M42 GRENADE IN THE M483A1 PROJECTILE

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19. ABSTRACT (CONTINUE ON REVERSE IF NECESSARY AND IDENTIFY BY BLOCK NUMBER)

In an effort to determine the safety characteristics of the high explosive (H.E.) loaded M42/M46 grenade body assemblies while stacked in the M483A1 projectile, a program was conducted to ascertain if unintentional initiation of the M55 detonator would propagate to the Composition A-5 main charge of the grenade above.

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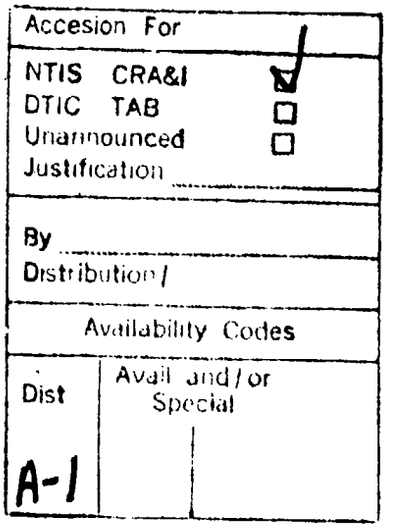


FIGURES

INTRODUCTION

The M42/M46 grenades are the cargo in the 155 mm, M483A1 ICM projectile. The grenades are dual purpose (antiarmor, antipersonnel) items. The M42 grenade is embossed while the M46 is smooth walled. Each grenade is loaded with a shaped charge of approximately 31 grams of Composition A-5 and a lead containing RDX. An M223 fuze, containing an M55 detonator, is assembled on each grenade (fig. 1). The grenades are stacked on top of each other in the 155-mm projectile body in eleven layers of eight each. When the M483A1 projectile is fired from the gun, the grenades are ejected from the projectile down range while the projectile is in flight. Upon ejection, the grenades separate from each other, the fuzes arm, and fuze function occurs on impact.

It was previously demonstrated, with tests, that initiation of the detonator while in the out-of-line position or even partially armed will not initiate the grenade lead or main charge. However, these tests were performed on individual grenade bodies (refs 1 and 2).

The nested grenade safety test was developed to simulate the stacking conditions in the M483A1 projectile. This test was performed to obtain data on the effects on a grenade in the event that a detonator in the fuze on the grenade immediately beneath it should accidentally be initiated. The grenade stacking arrangement is such that the detonator of each grenade is kept in the out-of-line position in the projectile by the grenade directly above, or, for the base layer, by an adapter.

OBJECTIVE

The purpose of this test program was to determine the safety characteristics of the high explosive (H.E.) loaded M42/M46 grenade body assemblies while stacked in the M483A1 projectile. The nested grenade safety test was developed to ascertain if unintentional initiation of the M55 detonator would propagate to the Composition A-5 main charge in the grenade above.

TEST DESCRIPTION

A test plan was developed that would simulate the grenade stacking arrangement in the M483A1 projectile. A fixture was designed and built to clamp two M42 grenade bodies together so that they would not separate when the detonator of the bottom grenade was initiated. This was the condition that would exist if a detonator was inadvertently initiated in the M483A1 grenade stack.

The test fixture consisted of two steel plates held together with bolts. The bottom grenade was nested on the first grenade shoulder in the same manner in which they are stacked in the projectile. The upper plate has a hole in it so that it could rest on the shouluer of the top grenade. The bolts were then tightened to rigidly hold the assembly together (fig. 2).

The bottom grenade has an inert main charge with a live (H.E.) lead cup and live (H.E.) M223 fuze. A T20E1 electric detonator was assembled to the fuze slide on top of the M55 detonator. This was used to initiate the M55 detonator.

The top grenade was an H.E. loaded M42 grenade body assembly without the M223 fuze. A small hole had to be drilled through the skirt area of each of the top grenade bodies to allow the wires for the electric detonator to pass through it.

A quantify of 50 nested grenade assemblies were fired for this test. Photographs were taken of the bodies after the test to have a visual record of the damage to the grenade bodies.

RESULTS

All 50 detonators in the M223 fuzes functioned as required in the test plan. There was no propagation to the Composition A-5 main charge in the top grenade. There was no propagation to any of the H.E. lead cup charges (ref 3).

At the completion of the 50 test firings, all 100 grenade body assemblies were visually examined. It was observed that there was no significant damage to the cones of the top grenades (fig. 3). Damage to the botton grenade assembly was confined to the fuze/ribbon assembly (fig. 4). The M223 fuze housing and ribbon assembly sustained severe damage but successfully contained the detonation. The output end of the detonator faces downward in the fuze and this also helped to confine the explosive energy. The ribbons were removed to determine the extent of damage to the fuze. It was clearly shown in figure 5 that although there was extensive damage to the fuze housing, the grenade body remained intact and the lead was not initiated.

CONCLUSIONS

In the unlikely event that an M55 detonator should accidentally initiate while in the grenade stack, the M483A1 projectile is safe. The tests confirmed that the detonation was confined to the area between the two nested grenades.

There was no propagation to the lead cup in the bottom grenade.

There was no propagation to the main charge or lead cup in the top grenade.

There was extensive damage to the M223 fuze housing and ribbon assembly which contained the initiated M55 detonator, but the detonation was contained with no propagation to either the top or bottom grenade.

REFERENCES

1. "Final Report on 155 mm M483A1 Projectile Premature in XM198 Weapon at APG on 25 November 1975," 155 mm Systems Engineering Management Office, Picatinny Arsenal, New Jersey, 19 April 1976.

2. "Testing M223 Fuze with Higher Strength Housings," Day & Zimmerman Technical Report 423, Kansas Division, Parsons, Kansas, 67357-9106, 27 May 1986.

3. 'MLRS - Special Test (M42)," LSAAP Report XX-5935, Lone Star Army Ammunition Plant, Texarkana, Texas, 15 May 1981.

Figure 1. M42 grenade

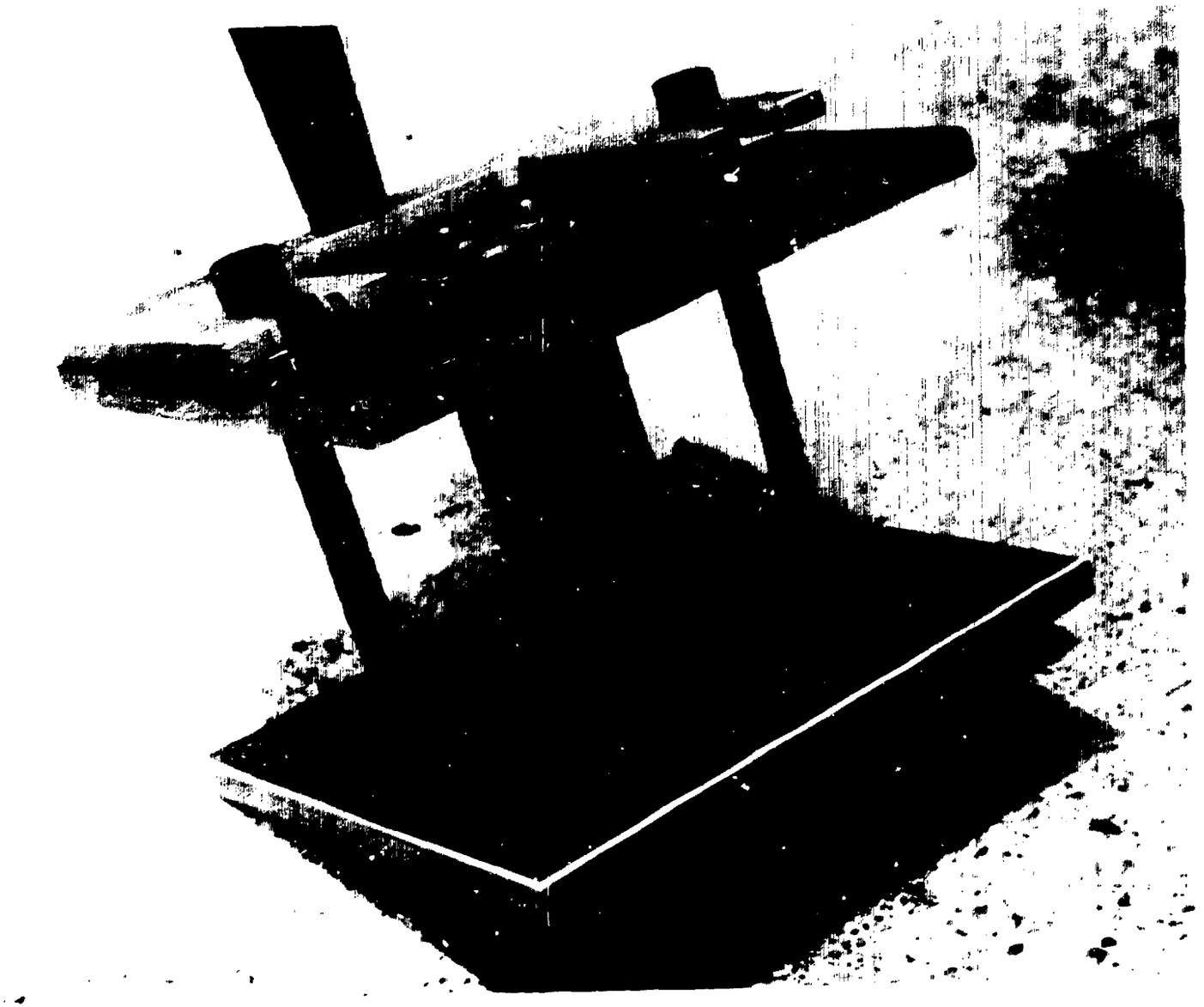
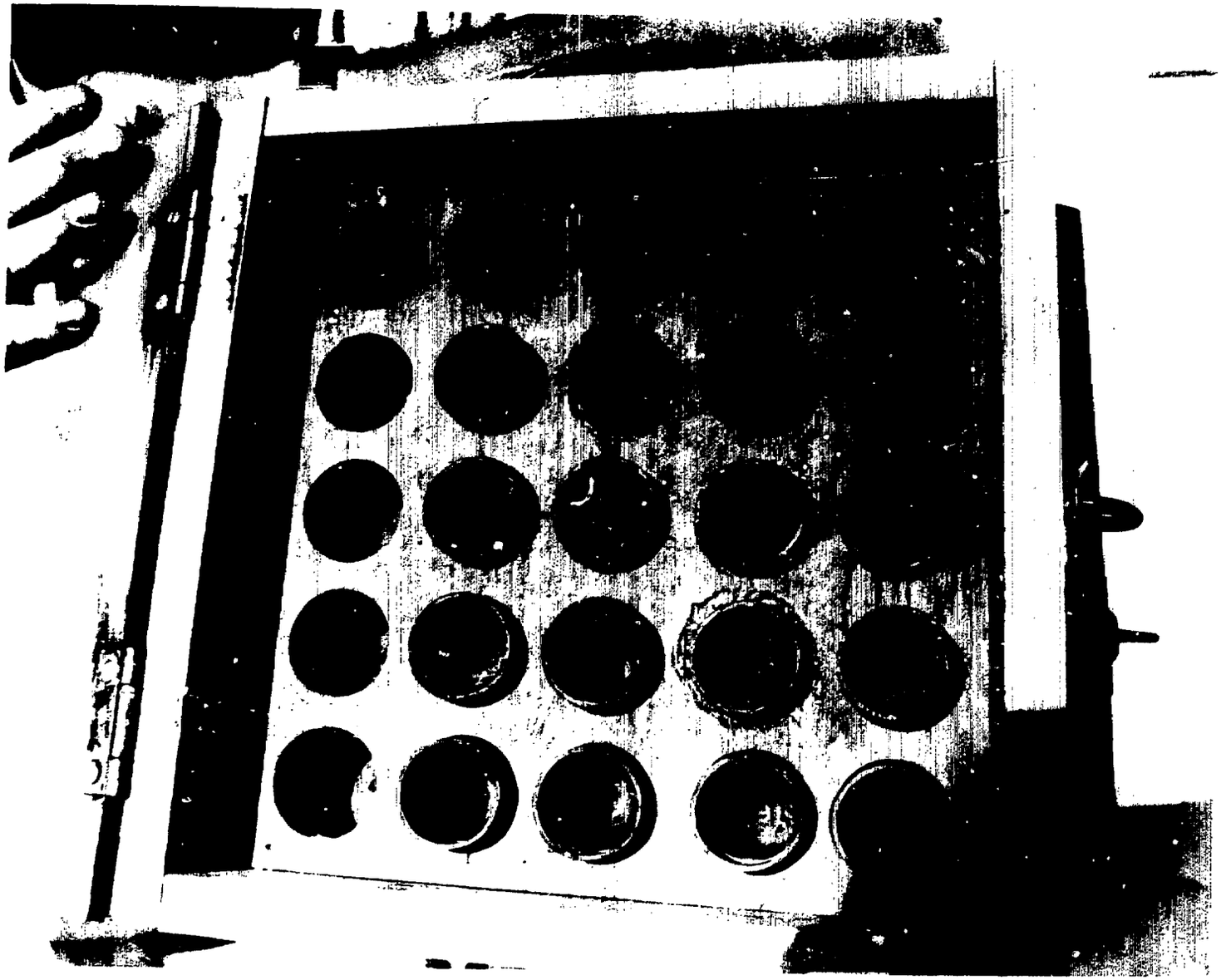


Figure 2. Test fixture

Figure 3. Cones of top grenades

Figure 3. (cont)



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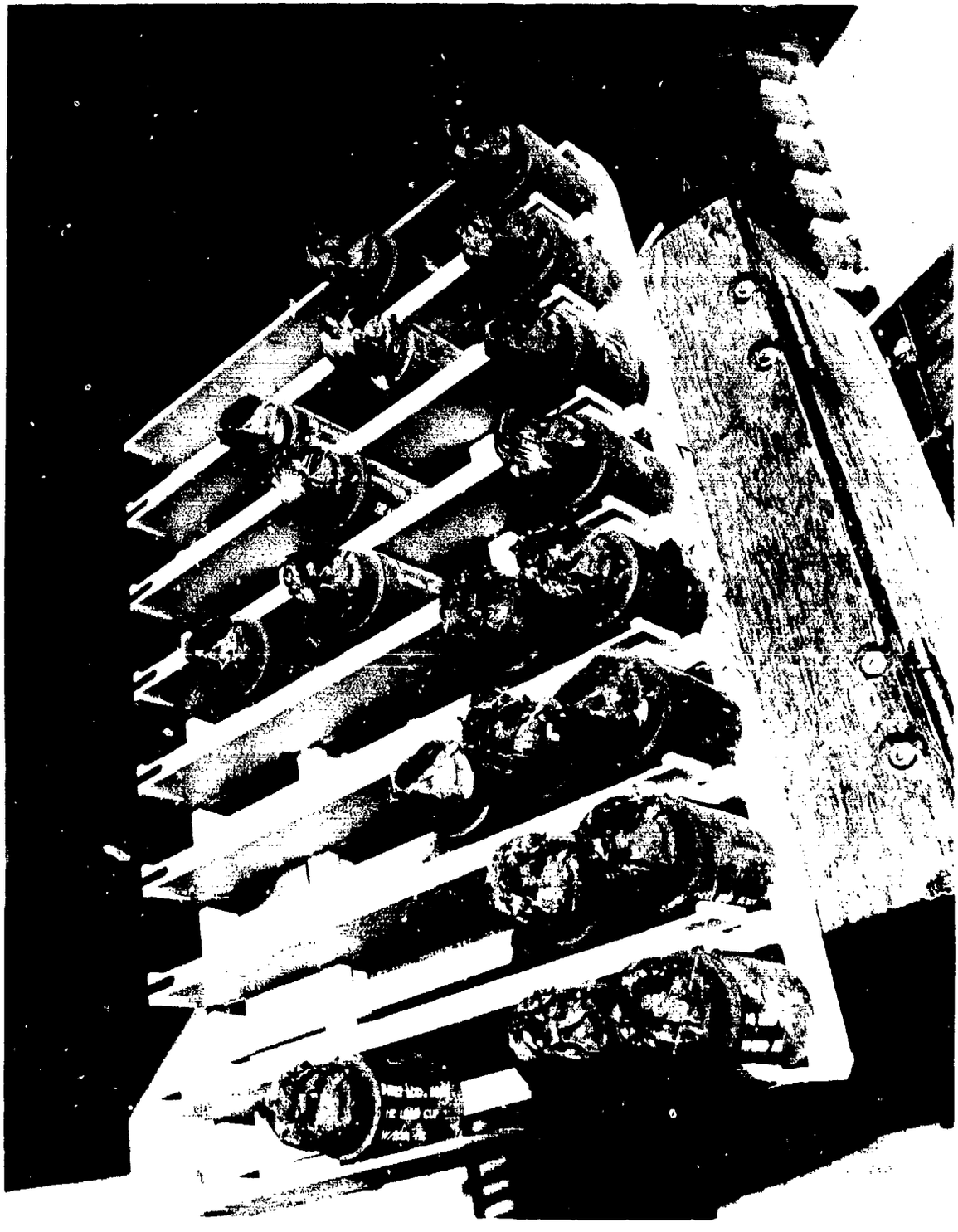


Figure 4. Fuzes of bottom grenade

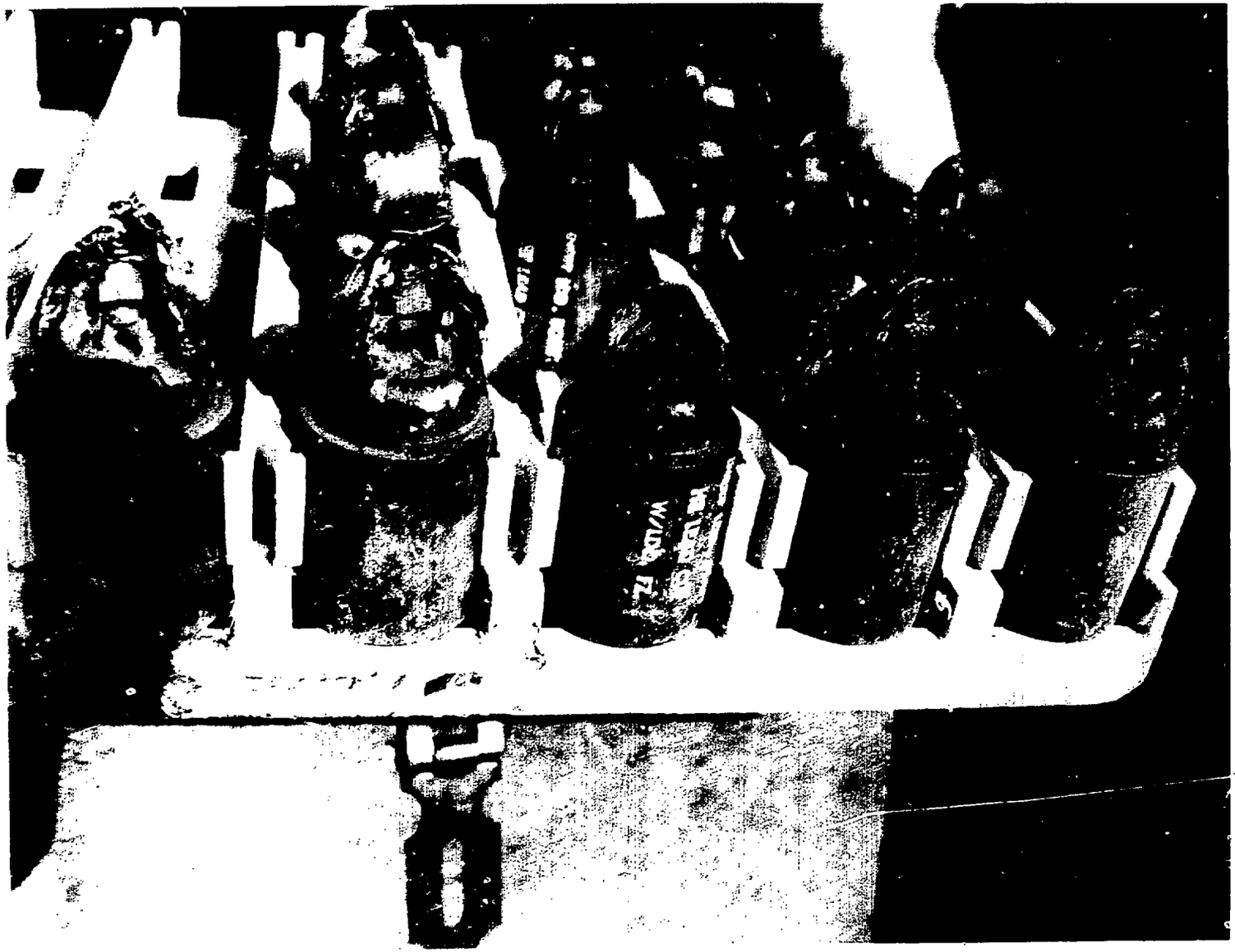
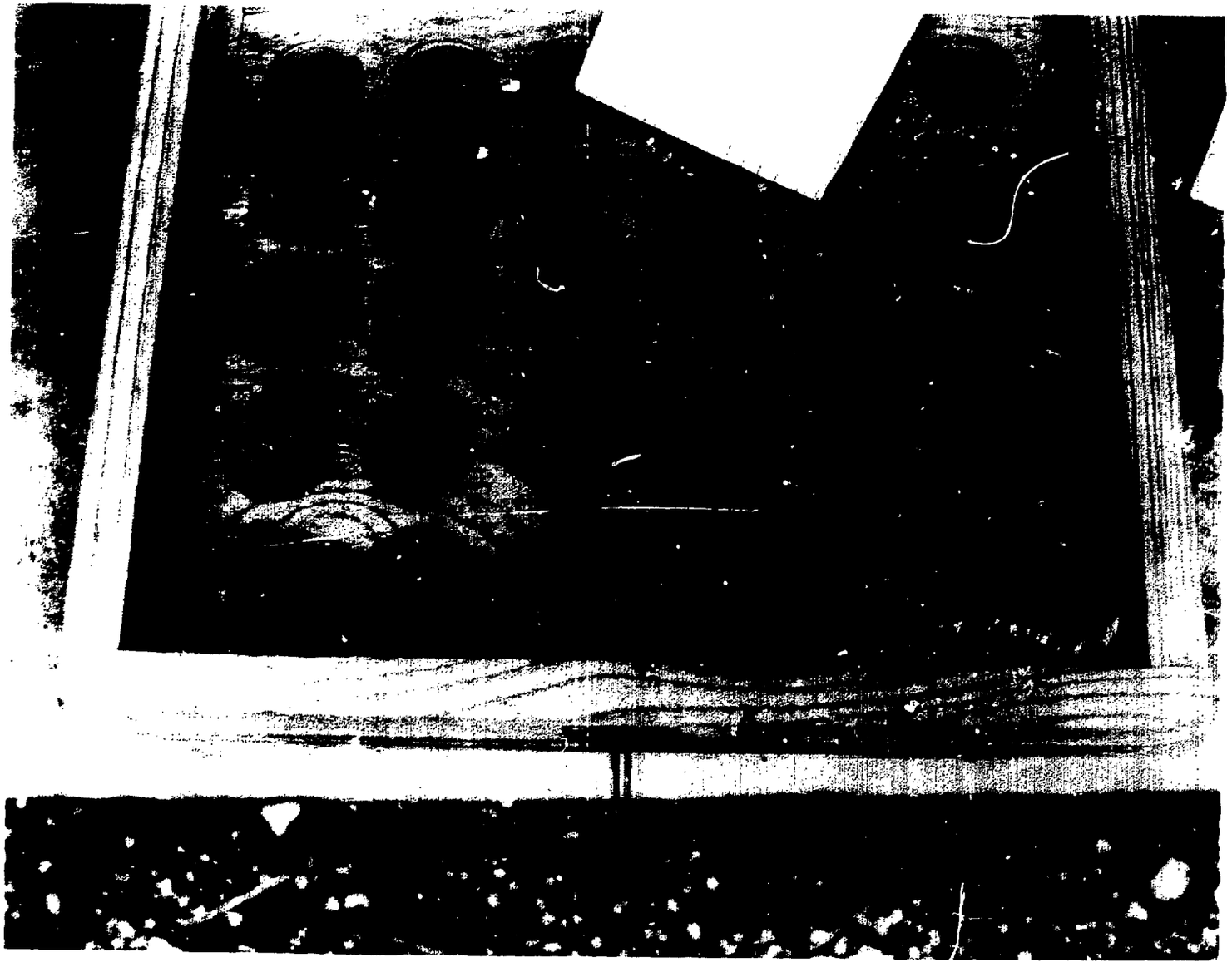


Figure 4. (cont)

Figure 5. Fuze bottom grenade ribbon removed



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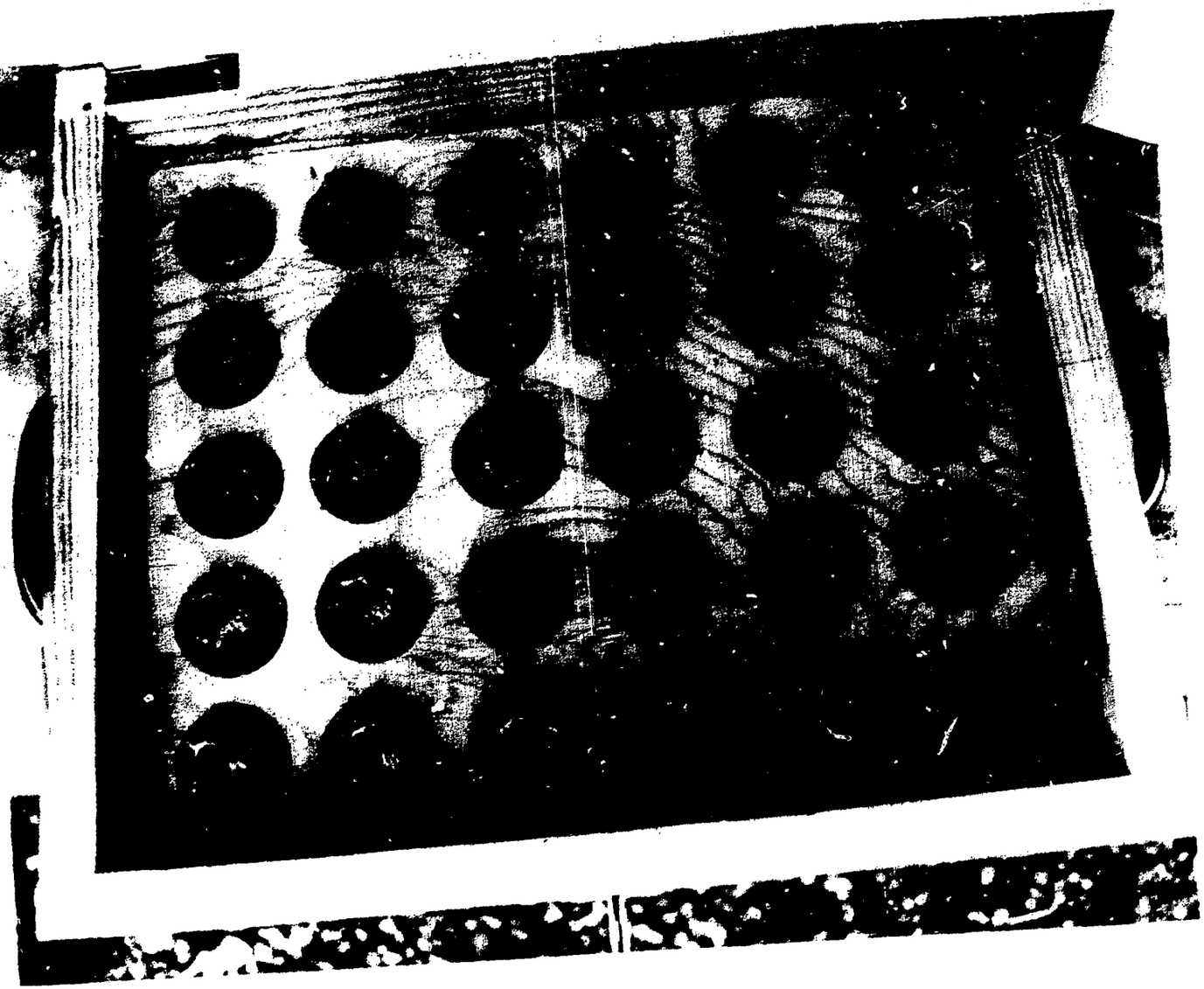

Figure 5. (cont)

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